URS

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Mr. Robert Robichaud
Environmental Protection Agency
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Elwha Water Treatment Plant Conceptual Design
Elwha River Restoration
Discharge of Residual Solids to Elwha River
URS Project Number 22235879

Dear Mr. Robichaud:

URS Corporation (URS) has been retained by the U.S. Bureau of Reclamation (Reclamation) to design the Elwha Water Treatment Plant (EWTP). The EWTP will provide industrial, fisheries, and municipal users with water during and after the removal of the Elwha River dams. Currently URS is developing design criteria and a conceptual design for this treatment plant.

This letter provides a summary of the EWTP design concept including the proposed return of residual solids from the treatment process to the Elwha River. This information has been developed as part of the EWTP conceptual design. This information includes the following:

- Background
- EWTP design information
  - Treated water demand
  - Treated water quality
  - Influent river water quality
  - Coagulants
  - Operating conditions
- Permitting
- Return of sediments to the river

BACKGROUND

The EWTP will treat water taken directly from the Elwha River for use by the Washington Department of Fish and Wildlife (WDFW) salmon-rearing channel, the Lower Elwha Klallam Tribal Hatchery (Tribal Hatchery), the Daishowa paper mill (Daishowa), and the City of Port Angeles (City) municipal system. The EWTP will treat water taken directly from the river during the dam removal and erosion period, which is expected to last between three and five years, beginning with the removal of the dams. After this period, it is expected that river water quality will return to a natural level.

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The EWTP will use a coagulation and sedimentation process to remove the suspended sediment from the river water and satisfy the treated water quality requirements of the end users. The anticipated high suspended sediment concentrations in the river water will generate large volumes of residual solids, which will make traditional dewatering and disposal of the residual solids impractical. The plant conceptual design has been developed based on the understanding that the residual solids can be returned to the river during the dam removal and erosion period. This is the same method of solids disposal presented in the *Elwha River Restoration Environmental Impact Statement (Elwha EIS)* (National Park Service 1996), which was provided to the Washington Department of Ecology and the Environmental Protection Agency (EPA) for review.

EWTP DESIGN INFORMATION

The following sections present the preliminary design requirements for the EWTP.

Treated Water Demand

The treated water demands are based on information provided to URS by the various users. The water demands of the fisheries users will be highly variable throughout the year, ranging from 0.6 to 14.2 million gallons per day (mgd) at the WDFW facility and from 1.7 to 12.4 mgd at the Tribal Hatchery. The demands for Daishowa and the City will be less variable. The average demands are approximately 9 and 4 mgd for Daishowa and the City, respectively, with corresponding maximum demands of approximately 14 and 11 mgd.

The total treated water demands for the mitigation period are summarized in Table 1. This table includes monthly water demands and approximate frequencies of occurrence for normal and maximum demand conditions.

Table 1
Water Demand Summary

	Normal (mgd)	**Maximum** (mgd)
Average	**20.6**	**36.8**
Minimum	**13.8**	**30.0**
Maximum	**35.6**	**51.8**
Frequency	***~99%***	***~1%***

Treated Water Quality

URS is currently working with Reclamation and the end users to establish the treated water quality parameters and limits. At this time, not all water quality parameters and limits have been established, but there is a general agreement upon the allowable turbidity. The limits for the treated water turbidity are 20 Nephelometric Turbidity Units (NTU) for continuous service, and 100 NTU for brief periods during rapid changes in river solids concentrations. The other parameters are related to metal concentrations. Fish toxicity is the primary concern with respect to metals concentrations, and URS has proposed to address this concern through a treated water toxicity-testing program.

Influent River Water Quality

Reclamation has studied the erosion and transport of the fine and coarse sediments that will be released with the removal of the Elwha dams. This was documented in the *Sediment Analysis and Modeling of the River Erosion Alternative, Elwha Technical Series PN-95-9 (Sediment Report)* (Reclamation 1996). The sediment transport modeling used actual flow records from the Elwha River during four periods (hydrologic scenarios), beginning in 1951, 1968, 1971, and 1989. These four hydrologic scenarios cover a range of river flow conditions from low flow years through high flow years. The hydrologic conditions are combined with the estimated sediment stratification within the reservoir and the dam removal/reservoir drawdown sequence to determine the probable fine sediment concentrations downstream of the lower dam. Each hydrologic scenario was modeled for a period of 15 years, with the majority of the fine sediments being transported during the dam removal and erosion period, which ranges from three to five years.

To determine operating requirements of the proposed EWTP, URS has reviewed the modeling results for the five years beginning with dam removal and subdivided the sediment loading conditions into three TSS ranges. The frequency of occurrence was then determined for each range. Table 2 summarizes the sediment-loading conditions and approximate frequencies based on the model output.

Table 2
Fine Sediment Loading Conditions

TSS Range (mg/l)	Frequency	Notes
0-500	~79%	
500-10,000	~20%	
>10,000	~1%	Maximum of 40,000 (June-March) Maximum of 20,000 (April –May)

Coagulants

URS has performed preliminary bench-scale testing for a series of alternative chemical coagulants and coagulant aids that may be used for the EWTP treatment process. Approximate influent dose rates are presented in Table 3 for two coagulants at four sediment-loading conditions; however, the final chemical selection and dose to TSS relationships will be defined based on an additional bench-scale treatability testing and coagulant toxicity.

Table 3
Expected Chemical Dosages

	Approximate Chemical Dosage (mg/l)	
TSS (mg/l)	Alum	Polyaluminum Chloride + Anionic Polyacrylamide
500	6 – 8	1 – 3 / 0.1 – 0.3
2,000	8 – 11	3 – 5 / 0.2 – 0.4
10,000	32 – 38	8 – 11 / 0.6 – 1.0
40,000	135 – 165	24 – 30 / 2.0 – 2.4

Operating Conditions

The EWTP will be designed to meet the water demands of the end users during all expected river water quality conditions. This range of flows and water qualities will result in a range of residual solids disposal conditions and associated frequencies. Table 4 presents a summary of treated water, influent and solids disposal flowrates for three treatment operating conditions (TC): TC-1, average flow condition with low solids concentration; TC-2, average flow condition with high solid concentration; and TC-3, peak flow condition with peak solids concentration.

Table 4
Expected Treatment Conditions

Condition	Parameter	Unit	Average	Minimum	Maximum
TC-1: Average Flow, 500 mg/l TSS, Frequency: ~79%	Treated water	mgd	20.6	13.8	35.6
	Influent	mgd	20.8	13.9	35.9
	Solids[1]	*mgd*	*0.2*	*0.1*	*0.3*
TC-2: Average Flow, 10,000 mg/l TSS Frequency: ~20%	Treated water	mgd	20.6	13.8	35.6
	Influent	mgd	22.0	14.7	37.9
	Solids[2]	*mgd*	*1.1*	*0.7*	*1.9*
TC-3: Peak Flow, 20,000 or 40,000 mg/l TSS Frequency: ~1%	Treated water	mgd	36.8	30	51.8
	Influent	mgd	47.1	39.6	59.1
	Solids[2]	*mgd*	*8.5*	*5.4*	*11.0*

[1]Solids flow rates based on residual solids concentration of 60,000 mg/l
[2] Solids flow rates based on residual solids concentration of 200,000 mg/l

Under the maximum solids discharge conditions (TC-3, 11.0 mgd) the solids disposal system would require daily disposal of up to 9,000 tons of dry solids or approximately 18,000 cubic yards of dewatered solids (based on 40-50% solids content). A conventional dewatering and hauling arrangement would require high-capacity/high-rate dewatering equipment, a high-efficiency truck loading system and approximately 1,000 truckloads per day; therefore, it would not be practical to provide conventional solids disposal for these conditions. Under the same solids condition, the river will be transporting approximately 160,000 tons of dry sediments per day (at a flow of 1,500 cfs), so the return of the solids to the river would increase the total solids transported by less than 10%. The frequency of occurrence of this situation is estimated to be less than one-percent of the operating period.

RETURN OF SEDIMENTS TO THE RIVER

The river water quality during the dam removal and erosion period will be significantly impacted by high concentrations of suspended sediments in the river. The concentrations are expected to range up to approximately 40,000 mg/l (daily average over the total river flow). The impact of these sediment concentrations on the river's aquatic life was presented in the *Elwha EIS*, and the impact was described as short-term "direct fish loss caused by extreme sediment levels". The *Elwha EIS* concluded that the river will be significantly impacted during the dam removal and erosion period (without considering the return of residual solids from the EWTP to the river), but mitigation will be provided for those impacts.

The impact of the solids discharge on river water quality will be a function of the solids discharge, river water suspended solids and river flowrates. Solids discharge rates will vary with the river water quality and water demands. Table 5 outlines the impacts to river water quality for three treatment plant conditions (TC-1, 2 and 3) at low and average river flows of 500 and 1,500 cubic feet per second (cfs), respectively.

Table 5
Estimated Impacts on River Water Quality

Parameter	Units	Parameter Values					
Treatment Plant Conditions		TC-1		TC-2		TC-3	
Frequency		*~79%*		*~20%*		*~1%*	
Treated water demand	mgd (cfs)	Average 20.6 (31.9)		Average 20.6 (31.9)		Maximum 51.8 (80.3)	
Influent TSS	mg/l	500		10,000		40,000	
Residual solids concentration	mg/l	60,000		200,000		200,000	
Residual solids discharge	gpm (cfs)	120 (0.268)		762 (1.7)		7,623 (17)	
River Conditions		Low	Average	Low	Average	Low	Average
Flowrate before solids discharge	cfs	500	1,500	500	1,500	500	1,500
TSS before solids discharge	mg/l	500		10,000		40,000	
TSS after solids discharge	mg/l	532	511	10,642	10,214	45,240	41,780
Solids concentration increase		6%	2%	6%	2%	13%	5%

The simplified evaluation presented in Table 5 shows that the increase in suspended sediments in the river will be less than 6% under the majority of operating conditions (99% of the time). Under the worst case conditions, which are likely to occur less than 1% of the time, the sediment concentrations may be increased by as much as 13%.

The fate of the sediments released from behind the dams is described in the *Sediment Report*. This report indicated "Fine sediment deposition would only occur in very slow-velocity areas such as channel flood plains, islands, pools, and in the Strait of Juan de Fuca." The EWTP residual solids discharged to the river are likely to behave similar to the fine sediments in the river. The residual solids will consist of the flocculated sediments, which will be small light particles that are easily disrupted. These particles are not likely to settle in the river because their structure will be disrupted as they are pumped from the clarifiers to the river, and the turbulent river conditions will prevent the particles from reforming. Because of these characteristics and the fact that there are a limited number of slow-velocity areas along the Elwha River, except during periods of flooding, the majority of the fine sediments are likely to be transported to the Strait, including the residual solids.

PERMITTING

URS understands that there will be several permits associated with the construction of the EWTP and the associated solids disposal concept, including a National Pollutant Discharge Elimination System (NPDES) permit, 401 water quality certification, Corps of Engineers 404 permit, Hydraulic Project Approval (HPA) and shoreline permits. Reclamation's Port Angeles office will coordinate the permitting of the EWTP.

ACTION REQUIRED

This matter is of critical importance to the design of the EWTP, and it is therefore necessary that we determine what information will be required by EPA to support this residual solids disposal concept.

Sincerely,
URS CORPORATION

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